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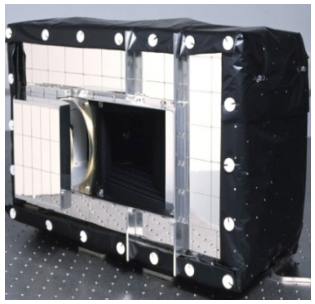
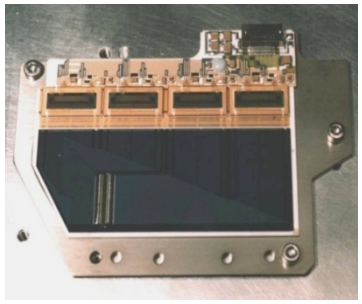
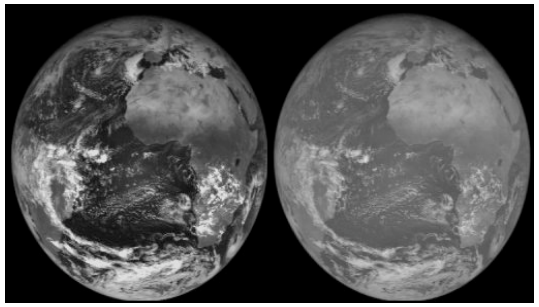
Geostationary Earth Radiation Budget
GERB 1 data release
GERB 2 calibration assessment




Jacqui Russell, (GERB project scientist)

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Validation: G1 /CERES
Swap effects
G2 calibration

GERB 1 / CERES inter-comparison LW radiances

LW unfiltered radiance comparison GERB 1 ARG & BARG / CERES Ed 2 rev 1

Allsky: 0.99 FM1 1.00 FM2
Day: 1.00 FM1 1.00 FM2
Night: 0.99 FM1 0.99 FM2

Averaged Rectified Geolocated (ARG)							
Scene Type	FM1	FM2	FM3	FM4	$< FM >$	$< L_g >$	ΔL
Allsky	0.993 ± 0.001	0.998 ± 0.001	0.988 ± 0.001	0.987 ± 0.002	0.991	83.47	-0.72
Day	1.000 ± 0.002	1.000 ± 0.002	0.989 ± 0.002	-	0.996	85.97	-0.35
Night	0.987 ± 0.002	0.993 ± 0.002	0.986 ± 0.002	0.987 ± 0.002	0.988	82.13	-0.97

Binned Averaged Rectified Geolocated (BARG)							
Scene Type	FM1	FM2	FM3	FM4	$< FM >$	$< L_g >$	ΔL
Allsky	0.993 ± 0.001	0.998 ± 0.001	0.988 ± 0.001	0.987 ± 0.002	0.991	83.52	-0.72
Day	0.999 ± 0.002	1.000 ± 0.001	0.988 ± 0.001	-	0.996	86.00	-0.37
Night	0.987 ± 0.001	0.993 ± 0.001	0.987 ± 0.002	0.987 ± 0.002	0.988	82.14	-0.96
Clearsky	0.988 ± 0.002	1.000 ± 0.002	0.988 ± 0.002	0.987 ± 0.002	0.991	95.45	-0.87
Cloudy	0.997 ± 0.003	0.992 ± 0.004	0.990 ± 0.004	0.987 ± 0.003	0.992	65.16	-0.54

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Validation: G1 /CERES
Swap effects
G2 calibration

GERB 1 / CERES inter-comparison SW radiances

LW unfiltered radiance comparison GERB 1 ARG & BARG / CERES Ed 2 rev 1

Allsky: *0.99-1.00* *FM1* *1.00* *FM2*

Scene effect BARG only:
Overcast: *0.99±0.01* *FM1* *0.99±0.01* *FM2*
Clear ocean: *1.04±0.03* *FM1* *1.02±0.01* *FM2*

Averaged Rectified Geolocated (ARG)							
Scene Type	FM1	FM2	FM3	FM4	$< FM >$	$< L_g >$	ΔL
Allsky	0.991 ± 0.009 (0.990)	1.000 ± 0.005 (1.001)	1.005 ± 0.008 (1.004)	-	0.999	72.56	-0.17
Binned Averaged Rectified Geolocated (BARG)							
Scene Type	FM1	FM2	FM3	FM4	$< FM >$	$< L_g >$	ΔL
Allsky	0.996 ± 0.005 (0.995)	1.001 ± 0.003 (1.001)	1.008 ± 0.005 (1.007)	-	1.002	72.82	0.07
Overcast	0.992 ± 0.012 (0.987)	0.994 ± 0.014 (0.998)	1.000 ± 0.014 (1.003)	-	0.995	189.27	-0.97
Clearsky	1.015 ± 0.022 (1.012)	1.010 ± 0.008 (1.006)	1.013 ± 0.034 (1.020)	-	1.013	50.90	0.61
ocean	1.035 ± 0.027 (1.026)	1.018 ± 0.030 (1.032)	0.982 ± 0.053 (1.003)	-	1.011	26.63	0.19
dark veg.	0.996 ± 0.011 (0.998)	1.003 ± 0.007 (1.005)	1.024 ± 0.010 (1.019)	-	1.008	47.73	0.41
bright veg.	0.991 ± 0.008 (0.994)	1.000 ± 0.006 (1.000)	1.039 ± 0.019 (1.043)	-	1.010	56.13	0.59
dark desert	-	0.997 ± 0.015 (1.000)	1.023 ± 0.010 (1.019)	-	1.010	77.36	0.77
bright desert	-	1.011 ± 0.006 (1.009)	1.028 ± 0.013 (1.028)	-	1.019	102.10	1.93

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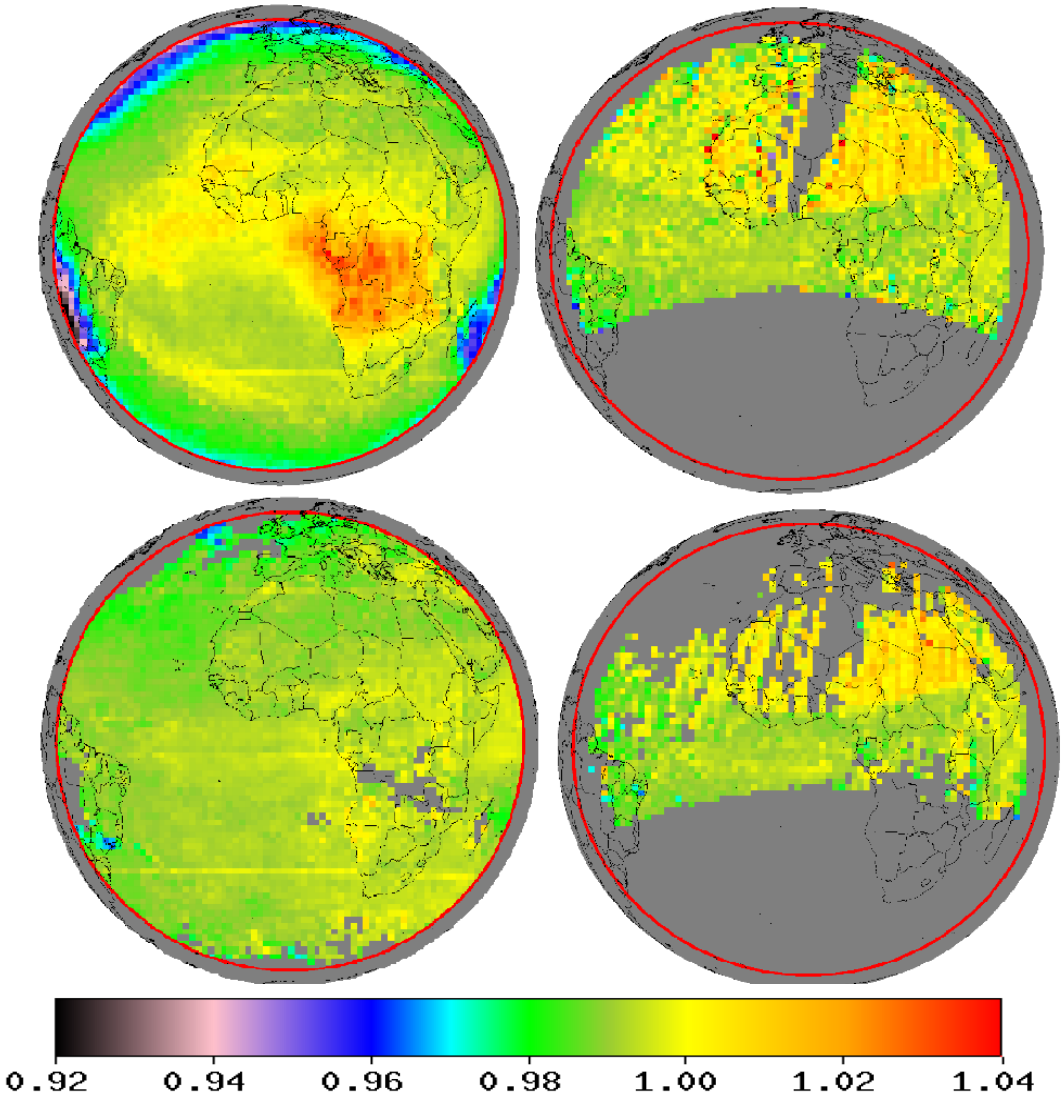
GERB 1 / CERES inter-comparison LW fluxes



Left
GERB 1 / CERES FM2 SSF Ed 2 rev 1 LW all sky top and clear sky bottom flux ratio

Right
GERB 1 / CERES FMx SSF Ed 2 rev 1 LW all sky top and clear sky bottom radiance ratio

Flux issues already identified as problems in GERB 2 / CERES comparison, to be addressed in Ed 2.

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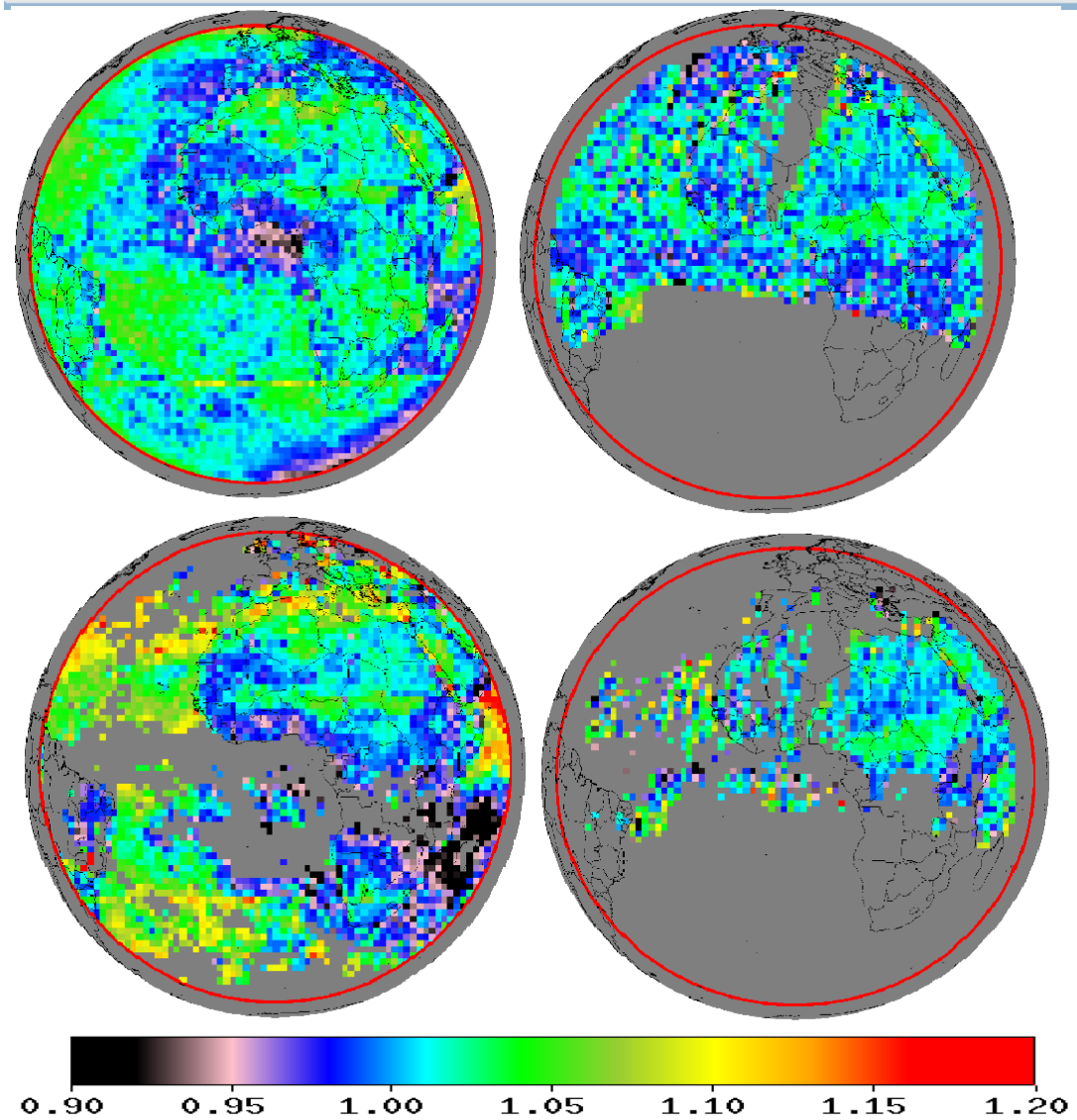
GERB 1 / CERES inter-comparison SW fluxes



Left
GERB 1 / CERES FM2 SSF Ed 2 rev 1 SW all sky top and clear sky bottom flux ratio

Right
GERB 1 / CERES FMx SSF Ed 2 rev 1 LW all sky top and clear sky bottom radiance ratio

~1% elevation c.f. Radiances as observed in the original GERB 2 / CERES comparison due to scene ID.

Scene differences in SW clear sky possibly due to fixed GERB viewing geometry.

GERB 1 to GERB 2 transition jump

Official swap from MSG 1 (METEOSAT-8 / GERB 2) to MSG-2 (METEOSAT-9 / GERB 1) is 10th May 2007

GERB Edition record will swap from GERB 2 (MSG-1) to GERB 1 (MSG-2) on 1st May 2007 to avoid a mixed instrument calendar month (requirement of the CMSAF)

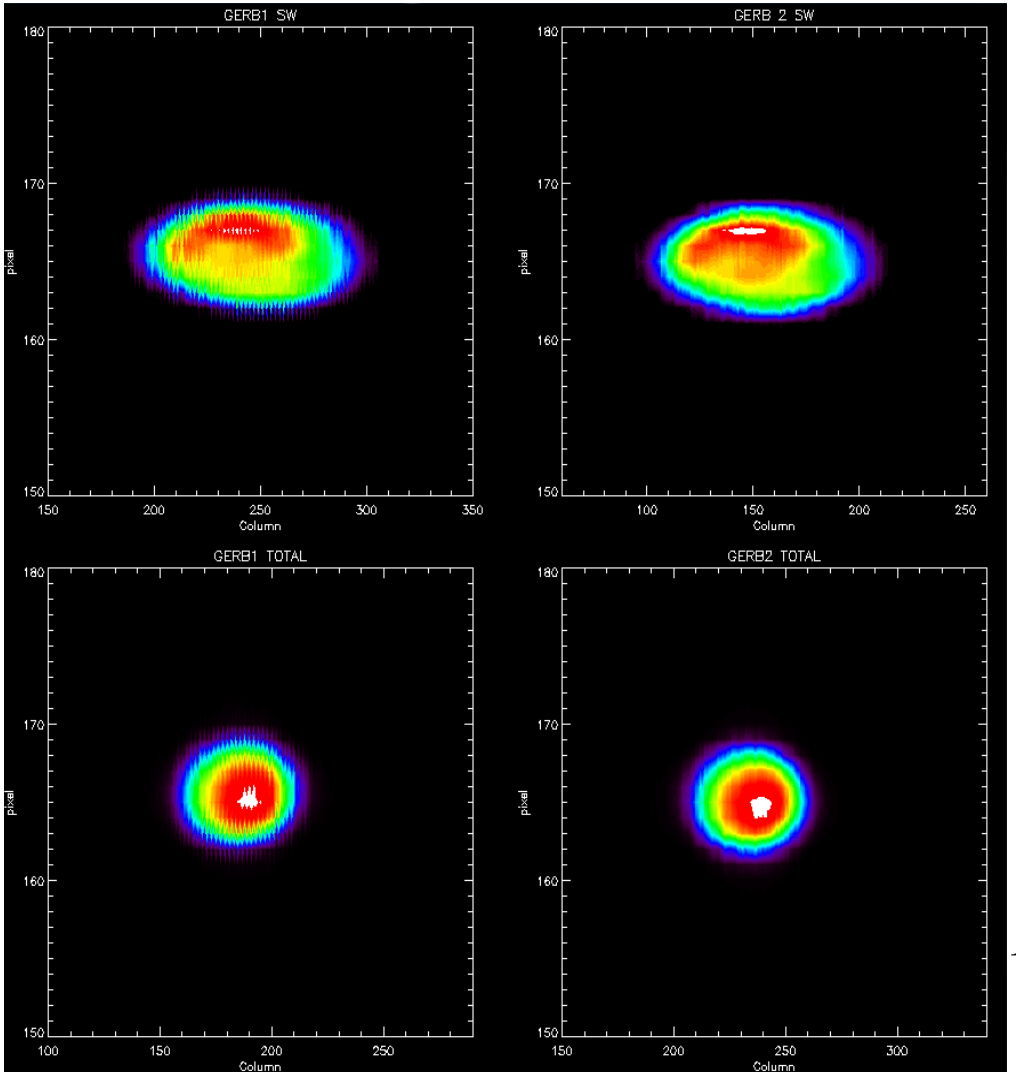
Detailed inter-comparison between the level 2 products reported by Bantges, full report made available to users differences are:

LW: GERB 1 on average 0.4% warmer in LW than GERB 2, but differences reach ~ 1% for coldest scenes

SW: GERB 1 on average 3.6% lower than GERB 2, (significant scene dependence with GERB 1 lower by 5.4% for clear land but by only 0.6% clear ocean)

For the BARG fluxes, no obvious effect of different timing, PSF or orbital position has been observed. However radiances and ARG, and NARG products will contain additional differences due to these factors.

GERB 1 & GERB 2 lunar observations



Lunar data processed from level 0, assumed identical instruments, no use of ground cal data.

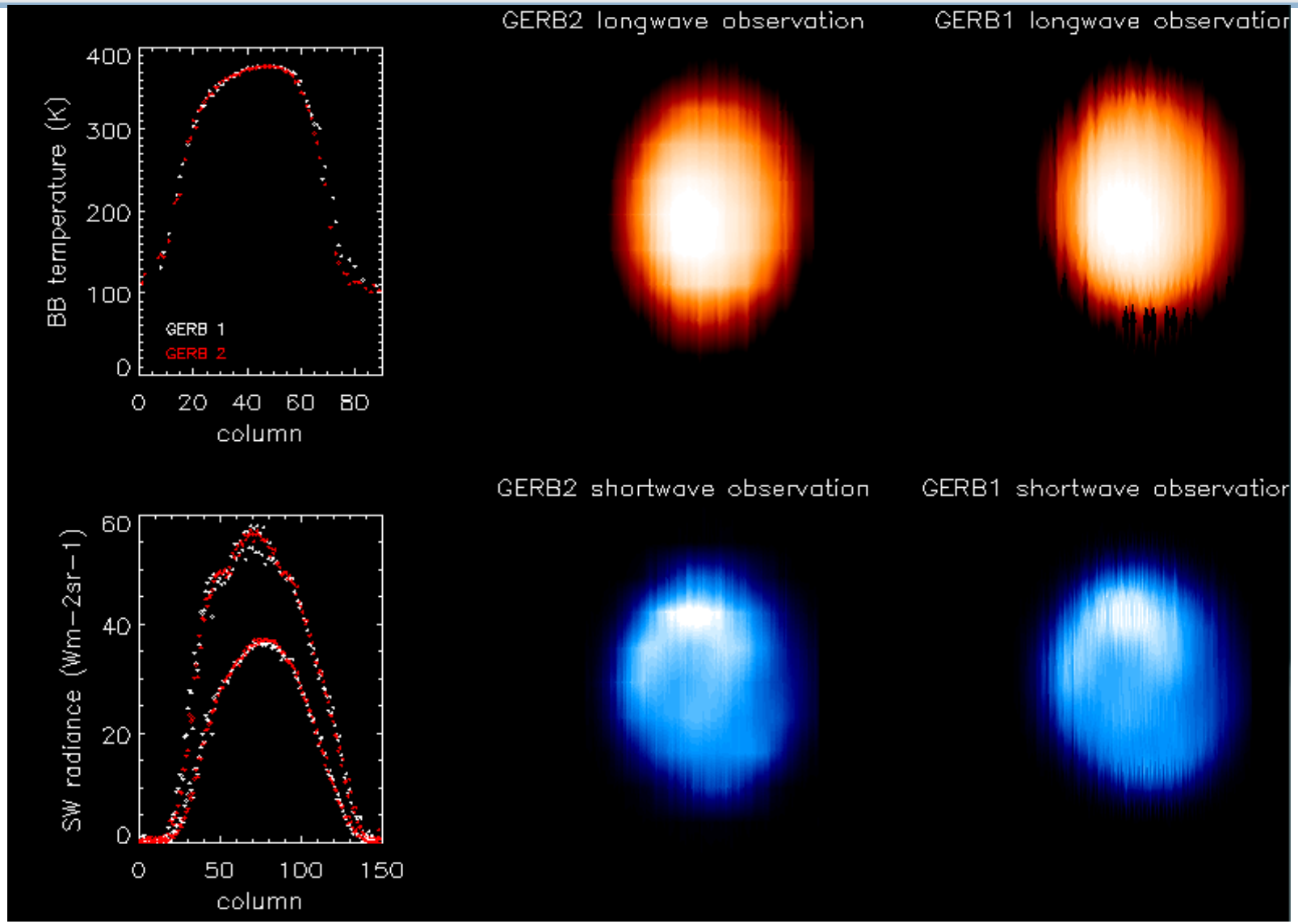
$$G' = \frac{V_{TOT}(IBB) - V_{TOT}(space)}{\frac{\sigma}{\pi} t_{IBB}^4}$$

$$L_{TOT}^{uf}(lunar) = \frac{V_{TOT}(EV) - V_{TOT}(space)}{G'}$$

$$L_{SW}^{uf}(lunar) = \frac{V_{SW}(EV) - V_{SW}(space)}{TG'}$$

$$L_{LW}^{uf}(lunar) = 1.0055 \times \left[L_{TOT}^{uf}(lunar) - L_{SW}^{uf}(lunar) \right]$$

GERB 1 & GERB 2 lunar observations



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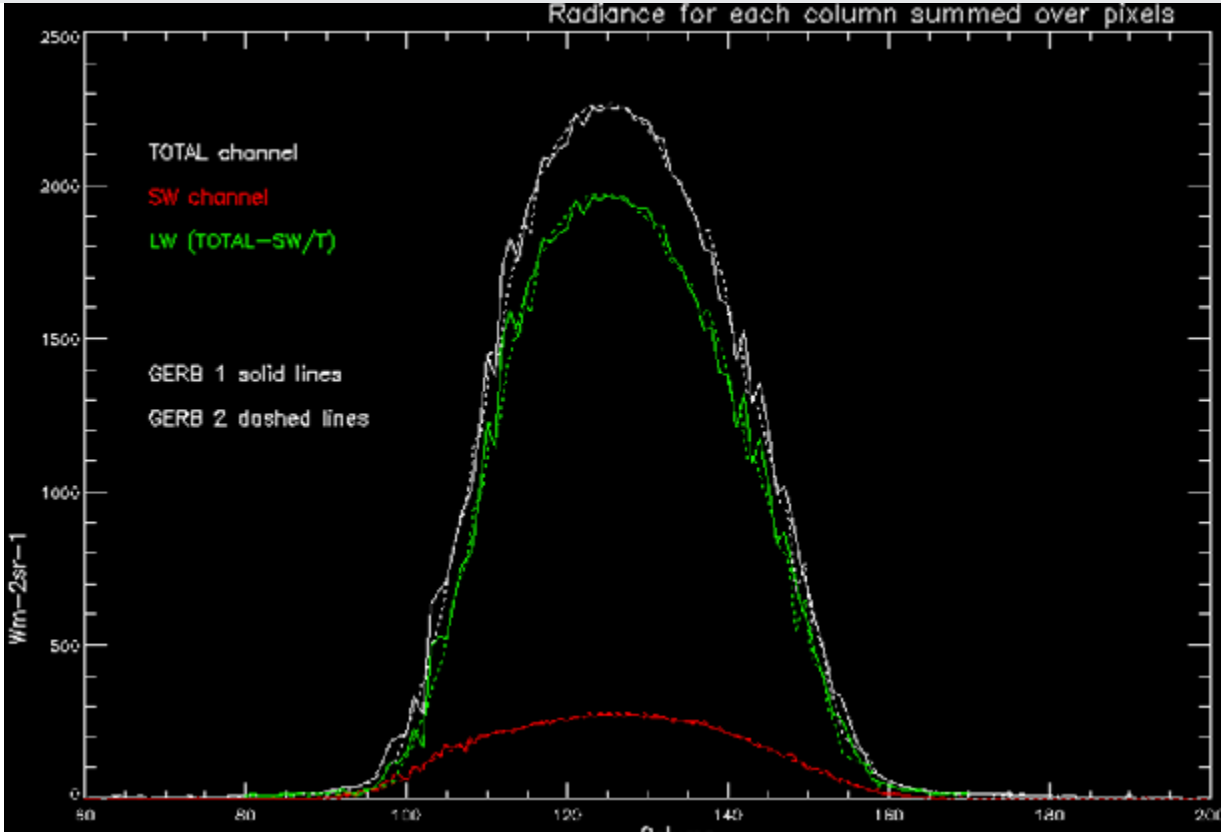
GERB 1 & GERB 2 lunar observations

***Peak SW**:*
G1=58.04 G2=57.29
0.75 Wm^{-2} sr^{-1} (1.3%)
***Summed SW**:*
G1=20691.5 G2=20637.0
54.5 Wm^{-2} sr^{-1} (0.3%)

***Peak TOTAL**:*
G1 = 408.18, G2=407.23
0.95 Wm^{-2} sr^{-1} (0.2%)
***Summed TOTAL**:*
G1 = 83572.0 G2=82241.7
1330.3 Wm^{-2} sr^{-1} (1.6%)

***Peak LW**:*
G1 = 367.12 G2=365.46
1.66 Wm^{-2} sr^{-1} (0.5%)
***Summed TOTAL**:*
G1=71458.3 G2=70188.1
1270.2 Wm^{-2} sr^{-1} (1.8%)



	Pixel range	Column range
GERB 1 SW	165 to 176	168 to 313
GERB 1 TOTAL	165 to 176	143 to 233
GERB 2 SW	163 to 175	76 to 225
GERB 2 TOTAL	163 to 175	192 to 281

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GERB 1 & GERB 2 lunar observations

***Peak SW**:*
G1=65.59 G2=68.75
-3.16 Wm^{-2} sr^{-1} (-4.6%)
***Summed SW**:*
G1=23381.4 G2=24764.4
-1383 Wm^{-2} sr^{-1} (-5.6%)

***Peak LW**:*
G1 = 374.57 G2=376.42
-1.85 Wm^{-2} sr^{-1} (-0.5%)
***Summed LW**:*
G1=72887.5 G2=72293.7
593.8 Wm^{-2} sr^{-1} (0.8%)

INCLUDING ground cal info
LW: 1.02xG1, 1.03xG2
=> Agreement with 1%

SW: 1.259 x for both GERB is B set to one

SW including differences in B
1.13xG1, 1.20xG2
=> G2 ~5% higher than G1

GERB 1 & GERB 2 ground cal consistency

- *Only a single ground cal for GERB 2 (2000) due to the acceleration of the GERB 2 programme*
- *3 ground cals for GERB 1 (1998/99, 2000 & 2003), one closest to launch used for operational calibration*

  – all consistently reanalysed

  Gain ratio obtained in 1999 and 2003 agree to within 0.1%

  Gain ratio obtained in 2000 6% lower!
- *This evidence in addition to the lunar differences observed when the Gain ratio is included persuaded NPL to review the calibration provided for the SW source in 2000 and 2003.*
- *This process led to updated calibration being provided for both the GERB 1 2000 calibration and the GERB 2 2000 calibration. Updated values improve by do not resolve the discrepancy*

  - After correction

  GERB 1 gain ratio in 2000 1.4% lower than 1999 and 2003 values

  GERB 2 gain ratio increased by 2.24% => SW radiance and flux x0.9775

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GERB 1 & GERB 2 lunar observations

***Peak SW**:*
G1=65.59 G2=67.03
-1.44 Wm^{-2} sr^{-1} (-2.1%)
***Summed SW**:*
G1=23381.4 G2=24145.3
-763.9 Wm^{-2} sr^{-1} (-3.2%)

***Peak LW**:*
G1 = 374.57 G2=376.42
-1.85 Wm^{-2} sr^{-1} (-0.5%)
***Summed TOTAL**:*
G1=72887.5 G2=72293.7
593.8 Wm^{-2} sr^{-1} (0.8%)

INCLUDING ground cal info
LW: 1.02xG1, 1.03xG2
=> Agreement with 1%

SW: 1.259 x for both GERB is B set to one

SW including differences in B
1.13xG1, 1.17xG2
=> G2 ~2 to 3% higher than G1

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GERB 1 & GERB 2 ground cal consistency

- *Using only instrument response to IBB and moon, and no calibration parameters, derived radiances for GERB 1 and GERB 2 are very similar.*

- *Including calibration parameters*

  LW: 1.02 x GERB 1 and 1.03 x GERB 2 (better than 1% agreement)

  SW: 1.13 x GERB 1 and 1.20 x GERB 2 (GERB 2 ~5% higher than GERB 1!)

- *New VISCS calibration for GERB 1 improve consistency between the 3 calibration, but 2000 cal still lower than prior and subsequent by 1.4%*
- *New VISCS calibration for GERB 2 would reduce the SW lunar difference to 2 to 3%*

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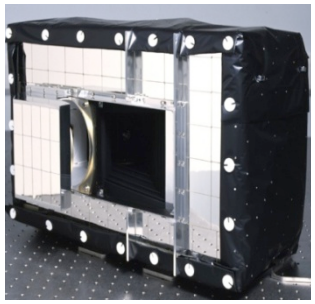
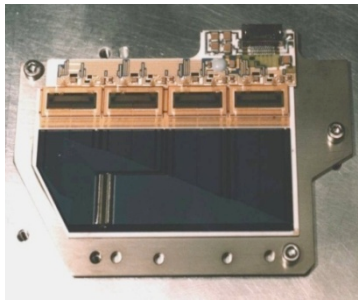
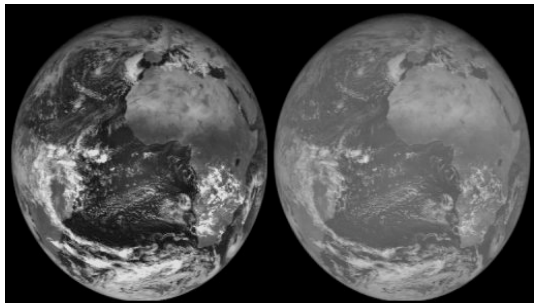
Geostationary Earth Radiation Budget GERB product status and planning




Jacqui Russell, (GERB project scientist)

GERB 1 release

Edition 1 GERB 1 data on the GGSPS, final Edition checks to determine data that needs to be 'pulled' (stray light etc) need to be finalised

Basic documents on inter-comparison and GERB 1 – CERES comparison written, GERB 1 update to quality summary being finished

Level 2 ARG and level 1.5 NANRG initial release products, but Level 2 BARG also covered by quality summary this time and is considered science quality
- BARG edition release awaits data fill field – now the next priorty!

First formal release with all associated documents end November this year, documents include details of difference to GERB 2, and adjustments can be provided if people want to make GERB 1 data look like GERB 2,
BUT an update to GERB 2 calibration expected too!

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GERB 2 ground cal update

- *Latest updated source calibration provided by NPL (2 weeks ago) for the 2000 GERB 2 calibration => GERB 2 SW x 0.978*

- *Plan to announce the GERB 1 release and updated knowledge regarding the GERB 2 calibration with recommendations at the same time*
  - *New VISCS data need to be carried through full end to calibration*
  - *Look further at GERB/CERES comparisons for evidence of GERB 2 change may be able to provide more definitive advice to users regarding this*

- *Longer term need a full survey of the data to track calibration*

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GERB 1 release
GERB 2 calibration
Product development

BARG fill field, averages & Edition 2

- *As proposed at previous GISTs we are devising a feasible way of including a **fill field in the BARG** with estimates for missing sun glint and terminator data*
  - *The above is a necessary set for monthly averages*

- ***User alert for the GERB 2 SW data adjustment**: gross level adjustment applied to all radiances in response to the updated calibration.*

- *Edition 2 will need to decide if **GERB 2 & GERB 1 remain independently calibrated or placed on the same radiometric scale** (GERB 1) based on in orbit studies*
  - *NOTE additional studies regarding change in calibration in orbit may require additional vicarious adjustment in any event, likely with a spectral component*

- *Our initial proposal would be to **keep the instantaneous data separate** for each instrument (not too difficult for user to adjust these if required). However **monthly average product would tie all instruments to common scale** (G1) and take all measures to ensure stability*